



PPL companies

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220 West Main Street  
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October 3, 2013

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7011 0110 0001 9643 9425**

Mr. Sean Alteri  
Acting Director and Assistant Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

**CERTIFIED NUMBER 7011 0110 0001 9643 9432**

Chief, Environmental Enforcement Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station  
Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7011 0110 0001 9643 9449**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions

Dear Mr. Alteri:

Please find enclosed a continuous assurance monitoring (CAM) plan that Kentucky Utilities' (KU) Ghent Generating Station has developed to fulfill a requirement of the Consent Decree recently entered between the United States and KU. The Consent Decree requires that a CAM plan for Ghent's sulfuric acid mist (SAM) emissions be submitted to the Kentucky Division for Air Quality (KDAQ) within 45 days of the Date of Entry of the Consent Decree. The Date of Entry of the Consent Decree was August 21, 2013 and this submittal is being made within the 45 day submittal deadline (i.e., by October 5, 2013).

This CAM plan contains the monitoring, recordkeeping and reporting processes that will be used for continuous assurance monitoring of Ghent's SAM emissions. Per the Consent Decree's language (see paragraph 23(a) of the Consent Decree), this CAM plan is being submitted to KDAQ for "review and approval". Additionally, with this submittal, KU is also submitting the "CAM Plan Revision" information required by the Consent Decree (see paragraph 23(b) of the Consent Decree). The information contained in the attached CAM plan which fulfills the

“revision” requirement was developed during testing which has already been conducted per the Consent Decree’s prescribed testing requirements. Therefore, KU is fulfilling the requirements of paragraph 23(a) and 23(b) of the Consent Decree with this CAM plan submittal. Subsequently, per paragraph 23(d) of the Consent Decree, KU will monitor the SAM indicative monitors and sorbent injection rates for each unit for comparison with the applicable performance indicators identified in the CAM plan, following approval of the CAM plan by KDAQ.

If KDAQ sees any issues that need to be addressed prior their approval of this CAM plan, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,



Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

Ec: Ben Markin, KDAQ

Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck

Steven Turner – KU Ghent  
David Smith

Gary Revlett – LG&E and KU Energy  
Steve Noland  
Bob Ehrler

## KENTUCKY UTILITIES PROPOSED SAM CAM PLAN – October 3, 2013

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NO<sub>x</sub>) emissions from Ghent Units 1, 3 and 4 are controlled by selective catalytic reduction (SCR) systems. All four units employ dry electrostatic precipitators (ESP) for control of particulate emissions with Ghent Unit 1 having a cold side ESP and all other units utilizing hot side ESPs. In addition, each unit employs a sulfur trioxide (SO<sub>3</sub>) mitigation system as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.



**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

<b>Ghent Unit</b>	<b>Interim SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Interim Compliance Date</b>	<b>Final SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Final Compliance Date</b>
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on Ghent Unit 2 to demonstrate compliance with its final SAM emission limit. KU has also begun conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

### 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

### 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.



Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU proposes to use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU further proposes to develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

Targeted Test Generation (MWg)		
Low	Mid	High
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will then be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the



	applicable interim or final emission limit.
Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance issues in an expedient manner; and (2) complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If



	corrective actions measures are not successful in returning the performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.
Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.

### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.

The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.



## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1750	3200	1500	2800	1000	1750
5-5.9	1750	3000	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1300	1000	1300	500	1300
5-5.9	1000	1300	500	1300	500	1000
≤4.9	1000	1300	500	1300	500	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2500	3000	2500	2500	1000	1500
5-5.9	2000	2500	2000	2000	1000	1000
≤4.9	2000	2000	1500	2000	500	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	1000	1250
≤4.9	2400	2500	2000	2000	1000	1250





Kentucky Utilities Company  
220 West Main Street  
P.O. Box 32030 (40232)  
Louisville, KY 40202

July 11, 2014

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7006 2760 0005 5304 0135**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

**CERTIFIED NUMBER 7006 2760 0005 5304 0081**

Chief, Environmental Enforcement Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station  
Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7006 2760 0005 5304 0098**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revision related to biannual SAM testing of KU Ghent Units 2, 3 and 4

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for SAM Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. Additionally, KU submitted a revision of the CAM plan on April 21, 2014 due to SAM testing conducted on KU Ghent Unit 1 in February 2014.

Stack testing in fulfillment of paragraph 22.b of the Consent Decree was conducted on KU's Ghent Unit 2 (May 12-14), Ghent Unit 3 (June 18-19) and Ghent Unit 4 (May 7-June 5). From those test results, KU has identified necessary revisions to the KU Ghent CAM plan particularly

for the alternate CAM indicator ranges. With Ghent Unit 2's testing being completed on May 14<sup>th</sup>, this revision submittal is being made within the 60 day submittal deadline.

Table 1, 2, and 3 below displays the alternate CAM indicator ranges for Ghent Units 2, 3, and 4 as seen in Appendix A to the April 21, 2014 revised KU Ghent Station CAM plan for SAM Emission Rates. Based on Consent Decree compliance testing conducted in 2012 and 2013, these were the minimum dry sorbent injection rates that indicated compliance with Ghent Unit 2, 3, and 4's interim SAM Emission Rate at specified generation load ranges and flue gas sulfur contents.

**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1300	1000	1300	500	1300
5-5.9	1000	1300	500	1300	500	1000
≤4.9	1000	1300	500	1300	500	1000

**Table 2. Alternate CAM Indicator Ranges for Ghent Generating Unit 3  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2500	3000	2500	2500	1000	1500
5-5.9	2000	2500	2000	2000	1000	1000
≤4.9	2000	2000	1500	2000	500	1000

**Table 3. Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	1000	1250
≤4.9	2400	2500	2000	2000	1000	1250



Based on the recent stack tests conducted on Ghent Unit 2, 3 and 4 between May 7, 2014 and June 19, 2014, Tables 4, 5 and 6 below shows the revised alternate CAM indicator ranges for Ghent Units 2, 3, and 4 in Appendix A.

**Table 4. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 2 Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1300	1000	1300	500	1300
5-5.9	1000	1200	500	1300	400	1000
≤4.9	1000	1200	400	1200	400	1000

**Table 5. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 3 Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

**Table 6. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 4 Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	1000	1250
≤4.9	2200	2500	2000	2000	500	350

For Ghent Unit 2, the stack test results demonstrated that compliance was achieved during the high, mid and low load levels of the May 2014 test using less dry sorbent injection under the conditions identified in Table 4. For Ghent Unit 4, the stack test results demonstrated that



compliance was achieved during the high and low load levels of the May/June 2014 test using less dry sorbent injection under the conditions identified in Table 6.

During its spring 2014 maintenance outage, Ghent Unit 3 added a pulse jet fabric filter for further control of particulate matter emissions and aid in controlling mercury emissions in order to achieve compliance with emission limits that will become effective under the Mercury and Air Toxic Standards. The June 2014 SAM stack test results demonstrated that the addition of the pulse jet fabric filter to Ghent Unit 3 allowed SAM limit compliance to be achieved with much less dry sorbent injection during the high, mid and low load levels as identified in Table 5. Additionally, upon adding the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 2, Ghent Unit 3 and Ghent Unit 4 will be adjusted slightly.

The revised CAM Plan is enclosed with this letter. All revised information is identified in red lettering. If KDAQ sees any issues that need to be addressed prior their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

A handwritten signature in blue ink that reads "Jason Wilkerson". The signature is fluid and cursive, with the first name "Jason" and last name "Wilkerson" clearly legible.

Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Derek Picklesimer, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck

## *KENTUCKY UTILITIES REVISED SAM CAM PLAN – JULY 11, 2014*

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NOx) emissions from Ghent Units 1, 3 and 4 are controlled by selective catalytic reduction (SCR) systems. All four units employ dry electrostatic precipitators (ESP) for control of particulate **matter (PM)** emissions with Ghent Unit 1 having a cold side ESP and all other units utilizing hot side ESPs. **As of May 2014, Ghent Unit 3's PM emissions are also controlled by a pulse jet fabric filter (PJFF).** In addition, each unit employs a sulfur trioxide (SO<sub>3</sub>) mitigation system as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.



**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

<b>Ghent Unit</b>	<b>Interim SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Interim Compliance Date</b>	<b>Final SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Final Compliance Date</b>
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on Ghent Unit 2 to demonstrate compliance with its final SAM emission limit. KU has also begun conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

## 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

## 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.



Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU **will** use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU **will** further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

<b>Targeted Test Generation (MWg)</b>		
<b>Low</b>	<b>Mid</b>	<b>High</b>
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will then be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.



Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance issues in an expedient manner; and (2) complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions measures are not successful in returning the

	performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.
Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

<b>Test Series</b>	<b>Number of Runs</b>	<b>Load Conditions</b>	<b>Sulfur Content</b>	<b>Sorbent Injection Rate</b>
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.



#### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.

The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.

## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1750	3200	1500	2800	1000	1750
5-5.9	1750	2500	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1300	1000	1300	500	1300
5-5.9	1000	1200	500	1300	400	1000
≤4.9	1000	1200	400	1200	400	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	1000	1250
≤4.9	2200	2500	2000	2000	500	350





Kentucky Utilities Company  
220 West Main Street  
P.O. Box 32030 (40232)  
Louisville, KY 40202

November 21, 2014

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7006 2760 0005 5304 0807**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

**CERTIFIED NUMBER 7006 2760 0005 5304 0814**

Chief, Environmental Enforcement Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station  
Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7006 2760 0005 5304 0821**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revisions related to biannual SAM testing of KU Ghent Units 1 and 3

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for SAM Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU submitted a revision of the CAM plan on April 21, 2014 due to SAM testing conducted on KU Ghent Unit 1 in February 2014. KU submitted an additional revision of the CAM plan on July 11, 2014 due to SAM testing conducted on KU Ghent Units 2, 3 and 4 in May and June of 2014.

Bi-annual stack testing in fulfillment of paragraph 22.b of the Consent Decree was conducted on KU's Ghent Unit 1 (September 23-25) and Ghent Unit 3 (October 8-9). From those test results, KU has identified that revisions to the alternate CAM indicator ranges for Ghent Unit 3 are not necessary. The October 2014 testing did not show a need to change the minimum sorbent injection rates established in the July 11, 2014 version of KU Ghent's SAM CAM plan. However, based on the September 2014 testing, revisions to the Ghent Unit 1 minimum sorbent injection rates are necessary.

Table 1 below displays the alternate CAM indicator ranges for Ghent Unit 1 as seen in Appendix A to the July 11, 2014 revised KU Ghent Station CAM plan for SAM Emission Rates.

**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 1  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1750	3200	1500	2800	1000	1750
5-5.9	1750	2500	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

Based on the September 2014 stack tests conducted on Ghent Unit 1, Tables 2 below shows the revised alternate CAM indicator ranges for Ghent Unit 1. The stack test results demonstrated that increased sorbent injection rates at high load levels are necessary to maintain compliance.

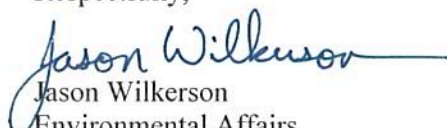
**Table 2. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 1  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	2700	3200	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 1 and Ghent Unit 3 will be adjusted slightly. Since Ghent Unit 1's testing was completed on September 25<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

The revised CAM Plan is enclosed with this letter. All revised information is identified in red lettering. If KDAQ needs additional information regarding this submittal prior to their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

  
Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Derek Picklesimer, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office



## *KENTUCKY UTILITIES REVISED SAM CAM PLAN – November 21, 2014*

### **GHENT SULFURIC ACID MIST CAM PLAN**

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NO<sub>x</sub>) emissions from Ghent Units 1, 3 and 4 are controlled by selective catalytic reduction (SCR) systems. All four units employ dry electrostatic precipitators (ESP) for control of particulate matter (PM) emissions with Ghent Unit 1 having a cold side ESP and all other units utilizing hot side ESPs. As of May 2014, Ghent Unit 3's PM emissions are also controlled by a pulse jet fabric filter (PJFF). In addition, each unit employs a sulfur trioxide (SO<sub>3</sub>) mitigation system as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.

**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

<b>Ghent Unit</b>	<b>Interim SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Interim Compliance Date</b>	<b>Final SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Final Compliance Date</b>
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on Ghent Unit 2 and Unit 3 to demonstrate compliance with their final SAM emission limit. KU has also begun conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

## 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

## 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent's SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.



Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU will use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU will further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

<b>Targeted Test Generation (MWg)</b>		
<b>Low</b>	<b>Mid</b>	<b>High</b>
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will then be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.



Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance issues in an expedient manner; and (2) complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions measures are not successful in returning the

	performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.
Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.



#### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.

The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.

## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	2700	3200	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1300	1000	1300	500	1300
5-5.9	1000	1200	500	1300	400	1000
≤4.9	1000	1200	400	1200	400	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	1000	1250
≤4.9	2200	2500	2000	2000	500	350



January 30, 2015

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7006 2760 0005 5304 0845**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

**CERTIFIED NUMBER 7006 2760 0005 5304 0852**

Chief, Environmental Enforcement Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station  
Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7006 2760 0005 5304 0869**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revisions related to biannual SAM testing of KU Ghent Units 2 and 4

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for SAM Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU submitted a revision of the CAM plan on April 21, 2014 due to SAM testing conducted on KU Ghent Unit 1 in February 2014. KU submitted an additional revision of the CAM plan on July 11, 2014 due to SAM testing conducted on KU Ghent Units 2, 3 and 4 in May and June of 2014. Additionally, KU submitted another revision of the CAM plan on November 21, 2014 due to SAM testing conducted on KU Ghent Units 1 and 3 in September and October of 2014.

The enclosed CAM plan revisions are being submitted following bi-annual stack testing that was conducted in fulfillment of paragraph 22.b of the Consent Decree on KU's Ghent Unit 2 (September 30 and December 4) and Ghent Unit 4 (December 17 and 23). From those test results, KU has identified necessary revisions to the KU Ghent CAM plan particularly for the alternate CAM indicator ranges.



**Kentucky Utilities Company**  
220 West Main Street  
P.O. Box 32030 (40232)  
Louisville, KY 40202

Tables 1 and 2 below displays the alternate CAM indicator ranges for Ghent Units 2 and 4 as seen in Appendix A to the November 21, 2014 revised KU Ghent Station CAM plan for SAM Emission Rates.

**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1300	1000	1300	500	1300
5-5.9	1000	1200	500	1300	400	1000
≤4.9	1000	1200	400	1200	400	1000

**Table 2. Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	1000	1250
≤4.9	2200	2500	2000	2000	500	350

Based on the September and December 2014 stack tests conducted on Ghent Units 2 and 4, Tables 3 and 4 below shows the revised alternate CAM indicator ranges for Ghent Units 2 and 4.

**Table 3. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	800	1400	500	1000
≤4.9	800	1300	800	1200	500	1000



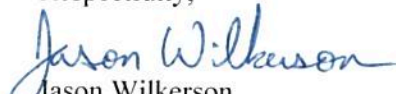
**Table 4. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	500	600
≤4.9	600	600	500	1000	500	350

Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 2 and Ghent Unit 4 will be adjusted slightly. Since Ghent Unit 2's testing was completed on December 4<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

The revised CAM Plan is enclosed with this letter. All revised information is identified in red lettering. If KDAQ needs additional information regarding this submittal prior to their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

  
Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Derek Picklesimer, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office

## KENTUCKY UTILITIES REVISED SAM CAM PLAN – January 30, 2015

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NO<sub>x</sub>) emissions from Ghent Units 1, 3 and 4 are controlled by selective catalytic reduction (SCR) systems. All four units employ dry electrostatic precipitators (ESP) for control of particulate matter (PM) emissions with Ghent Unit 1 having a cold side ESP and all other units utilizing hot side ESPs. Ghent Unit 3's PM emissions are also controlled by a pulse jet fabric filter (PJFF). *As of December 2014, Ghent Unit 4's PM emissions are also controlled by a PJFF.* In addition, each unit employs a sulfur trioxide (SO<sub>3</sub>) mitigation system as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.



**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

Ghent Unit	Interim SAM Limit (ppmvd@3% O <sub>2</sub> )	Interim Compliance Date	Final SAM Limit (ppmvd@3% O <sub>2</sub> )	Final Compliance Date
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on Ghent Unit 2, Unit 3 and Unit 4 to demonstrate compliance with their final SAM emission limit. KU has also been conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

## 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

## 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.

Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU will use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU will further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

<b>Targeted Test Generation (MWg)</b>		
<b>Low</b>	<b>Mid</b>	<b>High</b>
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the



alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.
Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance issues in an expedient manner; and (2) complete an inspection of the DSI system

	as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions measures are not successful in returning the performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.



Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.

### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.

The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a

correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.



## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	2700	3200	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	800	1400	500	1000
≤4.9	800	1300	800	1200	500	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	500	600
≤4.9	600	600	500	1000	500	350

May 6, 2015

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7006 2760 0005 5304 0913**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

**CERTIFIED NUMBER 7006 2760 0005 5304 0920**

Chief, Environmental Enforcement Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station  
Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7006 2760 0005 5304 0937**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revisions related to biannual SAM testing of KU Ghent Units 2 and 3

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for sulfuric acid mist (SAM) Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU has subsequently submitted additional revisions of the CAM plan on April 21, 2014, July 11, 2014, November 21, 2014, and January 30, 2015 due to SAM testing that was conducted on the KU Ghent Units.

The enclosed CAM plan revisions are being submitted following bi-annual stack testing that was conducted in fulfillment of paragraph 22.b of the Consent Decree on KU's Ghent Unit 2 (March 10-12) and Ghent Unit 3 (March 24-26). From those test results, KU has identified that revisions to the alternate CAM indicator ranges for Ghent Unit 3 are not necessary. The March 2015 testing did not show a need to change the minimum sorbent injection rates established in the July 11, 2014 version of KU Ghent's SAM CAM plan. However, based on the March 2015 testing, revisions to the Ghent Unit 2 minimum sorbent injection rates are necessary.



Kentucky Utilities Company  
220 West Main Street  
P.O. Box 32030 (40232)  
Louisville, KY 40202



Table 1 below displays the alternate CAM indicator ranges for Ghent Unit 2 as seen in Appendix A to the January 30, 2015 revised KU Ghent Station CAM plan for SAM Emission Rates.

**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
SO <sub>2</sub> (lb/mmBtu)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	800	1400	500	1000
≤4.9	800	1300	800	1200	500	1000

Based on the March 2015 stack tests conducted on Ghent Units 2, Table 2 below shows the revised alternate CAM indicator ranges for Ghent Unit 2.

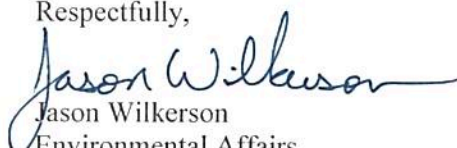
**Table 2. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

	Ghent Unit 2					
	Above 500 MW		500 to 450 MW		Below 450 MW	
SO <sub>2</sub> (lb/mmBtu)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	500	1400	400	1000
≤4.9	800	1300	500	1200	400	1000

Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 2 and Ghent Unit 3 will be adjusted slightly. Since Ghent Unit 2's testing was completed on March 11<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

The revised CAM Plan is enclosed with this letter. All revised information is identified in red lettering. If KDAQ needs additional information regarding this submittal prior to their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

  
Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Derek Picklesimer, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office

## KENTUCKY UTILITIES REVISED SAM CAM PLAN – May 6, 2015

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NOx) emissions from Ghent Units 1, 3 and 4 are controlled by selective catalytic reduction (SCR) systems. All four units employ dry electrostatic precipitators (ESP) for control of particulate matter (PM) emissions with Ghent Unit 1 having a cold side ESP and all other units utilizing hot side ESPs. Ghent Unit 3 and Ghent Unit 4's PM emissions are also controlled by a pulse jet fabric filter (PJFF). In addition, each unit employs a sulfur trioxide (SO<sub>3</sub>) mitigation system as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.



**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

<b>Ghent Unit</b>	<b>Interim SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Interim Compliance Date</b>	<b>Final SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Final Compliance Date</b>
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on Ghent Unit 2, Unit 3 and Unit 4 to demonstrate compliance with their final SAM emission limit. KU has also been conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

## 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

## 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.

Ghent Generating Station’s primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU will use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU will further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

Targeted Test Generation (MWg)		
Low	Mid	High
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor’s average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system’s performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit’s applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the



alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.
Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance

	issues in an expedient manner; and (2) complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions measures are not successful in returning the performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.



PERFORMANCE CRITERIA	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.
Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.

### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.

The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.



## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	2700	3200	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	500	1400	400	1000
≤4.9	800	1300	500	1200	400	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	500	600
≤4.9	600	600	500	1000	500	350

July 10, 2015

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7006 2760 0005 5304 0951**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

**CERTIFIED NUMBER 7006 2760 0005 5304 0968**

Chief, Environmental Enforcement Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station  
Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7006 2760 0005 5304 0975**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revisions related to biannual SAM testing of KU Ghent Units 1 and 4

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for sulfuric acid mist (SAM) Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU has subsequently submitted additional revisions of the CAM plan on April 21, 2014, July 11, 2014, November 21, 2014, January 30, 2015 and May 6, 2015 due to SAM testing that was conducted on the KU Ghent Units.

The enclosed CAM plan revisions are being submitted following bi-annual stack testing that was conducted in fulfillment of paragraph 22.b of the Consent Decree on KU's Ghent Unit 4 (May 12-14) and Ghent Unit 1 (June 9-11). Based on both sets of testing, revisions to the Ghent Unit 1 and Unit 4 minimum sorbent injection rates are necessary.

Table 1 and Table 2 below displays the alternate CAM indicator ranges for Ghent Unit 1 and Unit 4 as seen in Appendix A to the May 6, 2015 revised KU Ghent Station CAM plan for SAM Emission Rates.



Kentucky Utilities Company  
220 West Main Street  
P.O. Box 32030 (40232)  
Louisville, KY 40202



**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 1  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	2700	3200	1500	2500	1000	1500
≤4.9	1250	2500	1000	1500	1000	1250

**Table 2. Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	2400	2500	2000	2000	500	600
≤4.9	600	600	500	1000	500	350

Based on the May and June 2015 stack tests conducted on Ghent Unit 4 and Unit 1, Tables 3 and 4 below shows the revised alternate CAM indicator ranges for Ghent Unit 1 and Unit 4.

**Table 3. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 1  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500


**Table 4. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	1000	1000	1000	1000	500	600
≤4.9	600	600	500	500	500	350

Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 1 and Ghent Unit 4 will be adjusted slightly. Since Ghent Unit 4's testing was completed on May 14<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

The revised CAM Plan is enclosed with this letter. All revised information is identified in red lettering. If KDAQ needs additional information regarding this submittal prior to their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

  
Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Derek Picklesimer, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office



## KENTUCKY UTILITIES REVISED SAM CAM PLAN – July 10, 2015

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NO<sub>x</sub>) emissions from Ghent Units 1, 3, and 4 are controlled by selective catalytic reduction (SCR) systems. **Ghent Units 2, 3, and 4** employ dry **hot-side** electrostatic precipitators (ESP) for control of particulate matter (PM) emissions. **After a recent outage, Ghent Unit 1's ESP was replaced with a pulse jet fabric filter (PJFF) for control of PM emissions.** Ghent Unit 3 and Ghent Unit 4's PM emissions are also **further** controlled by PJFFs. In addition, **all four units** employ sulfur trioxide (SO<sub>3</sub>) mitigation systems as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.

**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

<b>Ghent Unit</b>	<b>Interim SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Interim Compliance Date</b>	<b>Final SAM Limit (ppmvd@3% O<sub>2</sub>)</b>	<b>Final Compliance Date</b>
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on **each unit** to demonstrate compliance with their final SAM emission limit. KU has also been conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

## 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

## 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.



Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU will use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU will further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

<b>Targeted Test Generation (MWg)</b>		
<b>Low</b>	<b>Mid</b>	<b>High</b>
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the

alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.
Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance



	issues in an expedient manner; and (2) complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions measures are not successful in returning the performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.

PERFORMANCE CRITERIA	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.
Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.

### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.



The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.

## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	500	1400	400	1000
≤4.9	800	1300	500	1200	400	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	1000	1000	1000	1000	500	600
≤4.9	600	600	500	500	500	350





a PPL company

December 14, 2015

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7015 1520 0000 7955 5422**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

Kentucky Utilities Company  
Environmental Affairs  
220 West Main Street  
P.O. Box 32010  
Louisville, KY 40232  
[www.lge-ku.com](http://www.lge-ku.com)

**CERTIFIED NUMBER 7015 1520 0000 7955 5439**

Chief, Environmental Enforcement Section Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7015 1520 0000 7955 5446**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revisions related to biannual SAM testing of KU Ghent Units 1, 3 and 4

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for sulfuric acid mist (SAM) Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU has subsequently submitted additional revisions of the CAM plan on April 21, 2014, July 11, 2014, November 21, 2014, January 30, 2015, May 6, 2015, and July 10, 2015 due to SAM testing that was conducted on the KU Ghent Units.

The enclosed CAM plan revisions are being submitted following bi-annual stack testing that was conducted in fulfillment of paragraph 22.b of the Consent Decree on KU's Ghent Unit 1 (November 02-05), Ghent Unit 3 (October 13-15), and Ghent Unit 4 (October 20-22). Based on this testing, only revisions to the Ghent Unit 4 minimum sorbent injection rates are necessary.

Table 1 below displays the alternate CAM indicator ranges for Ghent Unit 4 as seen in Appendix A to the July 10, 2015 revised KU Ghent Station CAM plan for SAM Emission Rates.

**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	1000	1000	1000	1000	500	600
≤4.9	600	600	500	500	500	350

Based on the October 2015 stack tests conducted on Ghent Unit 4, Table 2 below shows the revised alternate CAM indicator ranges for Ghent Unit 4.

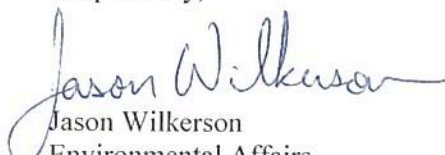
**Table 2. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 4  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	350

Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 1, Ghent 3, and Ghent Unit 4 will be adjusted slightly. Since Ghent Unit 3's testing was completed on October 15<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

The revised CAM Plan is enclosed with this letter. All revised information is identified in red lettering. If KDAQ needs additional information regarding this submittal prior to their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

  
Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Rick Shewekah, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office



## *KENTUCKY UTILITIES REVISED SAM CAM PLAN – December 14, 2015*

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NO<sub>x</sub>) emissions from Ghent Units 1, 3, and 4 are controlled by selective catalytic reduction (SCR) systems. **Ghent Units 3 and 4** employ dry hot-side electrostatic precipitators (ESP) for control of particulate matter (PM) emissions. **After recent outages, Ghent Unit 1 and 2's ESPs were replaced with pulse jet fabric filters (PJFF) for control of PM emissions.** Ghent Unit 3 and Ghent Unit 4's PM emissions are also further controlled by PJFFs. In addition, all four units employ sulfur trioxide (SO<sub>3</sub>) mitigation systems as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	<p>KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b></p> <p>KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b></p> <p>KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b></p> <p>KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b></p>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. The table below reflects the terms of the final Consent Decree entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The final Consent Decree stipulates some monitoring requirements.

**TABLE 1.1.3: GHENT STATION CONSENT DECREE EMISSION LIMITS AND COMPLIANCE DATES**

Ghent Unit	Interim SAM Limit (ppmvd@3% O <sub>2</sub> )	Interim Compliance Date	Final SAM Limit (ppmvd@3% O <sub>2</sub> )	Final Compliance Date
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on each unit to demonstrate compliance with their final SAM emission limit. KU has also been conducting the bi-annual stack tests at each unit per the requirements of the Consent Decree that are to last for at least two years following the Date of Entry of the Consent Decree. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in Paragraph 22(b) of the Consent Decree.

### 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

### 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.



Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU will use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU will further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

Targeted Test Generation (MWg)		
Low	Mid	High
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance, the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the

alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The SAM Indicative Monitor output will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. A deviation of this section of the CAM plan will be defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.
Corrective Actions	In response to a deviation, KU will (1) complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance



	issues in an expedient manner; and (2) complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
Verification of Operational Status	KU will follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices.
QA/QC Practices and Criteria	KU will calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate (pounds per hour, lb/hr) will be recorded and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration testing performed pursuant to the Consent Decree. A deviation of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). A deviation of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.
Corrective Actions	In response to a deviation, KU will complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. If corrective actions measures are not successful in returning the performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.

PERFORMANCE CRITERIA	
Data Representativeness	The DSI injection rates will be determined from data collected during compliance demonstration testing.
Verification of Operational Status	KU will follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.
QA/QC Practices and Criteria	The DSI systems will be maintained and operated by KU in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	A summary of deviations and corrective actions will be included in the semi-annual Consent Decree report and into Title V reporting after Consent Decree requirements are incorporated into Ghent's Title V operating permit.

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing

## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.

### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.



The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in paragraph 23c of the Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required by paragraph 23(c)(i) of the Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.

## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	500	1400	400	1000
≤4.9	800	1300	500	1200	400	1000

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	350





a PPL company

February 15, 2016

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7015 1520 0000 7955 5507**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

Kentucky Utilities Company  
Environmental Affairs  
220 West Main Street  
P.O. Box 32010  
Louisville, KY 40232  
www.lge-ku.com

**CERTIFIED NUMBER 7015 1520 0000 7955 5514**

Chief, Environmental Enforcement Section Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7015 1520 0000 7955 5521**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Revisions related to biannual SAM testing of KU Ghent Unit 2

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for sulfuric acid mist (SAM) Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU has subsequently submitted additional revisions of the CAM plan on April 21, 2014, July 11, 2014, November 21, 2014, January 30, 2015, May 6, 2015, July 10, 2015, and December 14, 2015 due to SAM testing that was conducted on the KU Ghent Units.

The enclosed CAM plan revisions are being submitted following bi-annual stack testing that was conducted in fulfillment of paragraph 22.b of the Consent Decree on KU's Ghent Unit 2 (December 15-17). Based on this testing, revisions to the Ghent Unit 2 minimum sorbent injection rates are necessary.

Table 1 below displays the alternate CAM indicator ranges for Ghent Unit 2 as seen in Appendix A to the December 14, 2015 revised KU Ghent Station CAM plan for SAM Emission Rates.

**Table 1. Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	1000	1400	500	1400	400	1000
≤4.9	800	1300	500	1200	400	1000

Based on the December 2015 stack tests conducted on Ghent Unit 2, Table 2 below shows the revised alternate CAM indicator ranges for Ghent Unit 2.

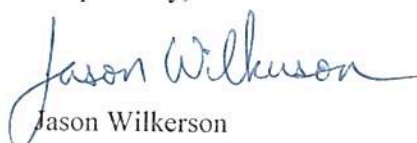
**Table 2. Revised Alternate CAM Indicator Ranges for Ghent Generating Unit 2  
Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)**

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	A-Duct Injection Rate (lb/hr)	B-Duct Injection Rate (lb/hr)	A-Duct Injection Rate (lb/hr)	B-Duct Injection Rate (lb/hr)	A-Duct Injection Rate (lb/hr)	B-Duct Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 2 will be adjusted slightly. Since Ghent Unit 2's testing was completed on December 17<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

The revised CAM Plan is enclosed with this letter. In addition to changes in alternate CAM indicator ranges for Ghent Unit 2, revisions were made in the CAM plan to reflect the incorporation of the consent decree requirements into the station's Title V operating permit. All revised information is identified in red lettering. If KDAQ needs additional information regarding this submittal prior to their approval of this CAM plan revision, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,



Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Rick Shewekah, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office



## KENTUCKY UTILITIES REVISED SAM CAM PLAN – February 15, 2016

### GHENT SULFURIC ACID MIST CAM PLAN

This document contains the Compliance Assurance Monitoring (CAM) plan being proposed for the sulfuric acid mist (SAM) control systems for the Kentucky Utilities' (KU) Ghent Generating Station Units 1, 2, 3 and 4. The control trains for Ghent Units 1, 2, 3, and 4 include individual wet flue gas desulfurization (WFGD) systems. Ghent Units 2 and 3 share a common chimney with a single flue. Nitrogen oxide (NO<sub>x</sub>) emissions from Ghent Units 1, 3, and 4 are controlled by selective catalytic reduction (SCR) systems. Ghent Units 3 and 4 employ dry hot-side electrostatic precipitators (ESP) for control of particulate matter (PM) emissions. After recent outages, Ghent Unit 1 and 2's ESPs were replaced with pulse jet fabric filters (PJFF) for control of PM emissions. Ghent Unit 3 and Ghent Unit 4's PM emissions are also further controlled by PJFFs. In addition, all four units employ sulfur trioxide (SO<sub>3</sub>) mitigation systems as the primary control system to minimize the formation and emission of SAM.

**TABLE 1.1.1: CAM BACKGROUND**

Facility:	Kentucky Utilities — Ghent Generating Station Ghent, Kentucky Source ID# 21-041-00010
Emission Unit Identification:	KyEIS Source ID# 01 <b>Unit 1 Indirect Heat Exchanger</b>  KyEIS Source ID# 02 <b>Unit 2 Indirect Heat Exchanger</b>  KyEIS Source ID# 03 <b>Unit 3 Indirect Heat Exchanger</b>  KyEIS Source ID# 04 <b>Unit 4 Indirect Heat Exchanger</b>
SAM Controls:	The SAM emissions from each unit will be controlled primarily by dry sorbent injection (DSI) systems.

**TABLE 1.1.2: APPLICABLE REGULATIONS AND CURRENT MONITORING FOR SAM**

Pollutant:	Sulfuric Acid Mist (SAM)
Regulation:	Ghent Units 1, 2, 3 and 4 are not presently subject to regulations which apply SAM emissions limits on the units. <b>Table 1.1.3</b> below reflects the terms of the <b>current Title V operating permit that has incorporated the Consent Decree</b> that was entered into between the United States and KU establishing interim and final unit-specific SAM emission limits and compliance dates.
Current Monitoring Requirements:	As there are currently no regulation-based SAM emission limits, there are no current regulatory-based monitoring requirements specifically for SAM. The <b>current Title V operating permit that has incorporated the Consent Decree</b> stipulates some monitoring requirements.

TABLE 1.1.3: GHENT STATION **TITLE V/CONSENT DECREE** EMISSION LIMITS AND COMPLIANCE DATES

Ghent Unit	Interim SAM Limit (ppmvd@3% O <sub>2</sub> )	Interim Compliance Date	Final SAM Limit (ppmvd@3% O <sub>2</sub> )	Final Compliance Date
1	7	August 31, 2012	5	June 30, 2015
2	5	August 31, 2012	4	June 30, 2013
3	7	August 31, 2012	5	June 30, 2014
4	10	December 31, 2012	5	December 31, 2014

KU has successfully conducted the stack test(s) necessary to complete the initial compliance demonstration procedures for the interim SAM emission limit applicable to each unit. Additionally, KU has successfully completed testing on each unit to demonstrate compliance with their final SAM emission limit. KU has also been conducting the bi-annual stack tests at each unit per the requirements of the **current Title V permit that incorporates the** Consent Decree that are to last for at least two years following **August 21, 2013**. Thereafter, KU shall perform stack tests at each unit consistent with the timing identified in **Item 3e for each unit in the current Title V permit that incorporates the** Consent Decree.

## 1.2 CAM APPLICABILITY

The individual emissions from Ghent Units 1, 2, 3 and 4 are subject to emission limits as described in the **current Title V permit that incorporates the** Consent Decree and seen in Table 1.1.3 above. According to paragraph 70 of the Consent Decree, KU is required to obtain “enforceable provisions in its Title V permit for Ghent Station that incorporate all Unit-specific permanent SAM Emission Rates” contained in the Consent Decree. **The Consent Decree requirements were incorporated into Ghent Station’s Title V permit (#V-12-028(R1)) that was issued on October 16, 2015.** Pursuant to 40CFR64 Section 2(a), because the SO<sub>3</sub> mitigation systems are used to achieve compliance with these emission limits and potential pre-controlled SAM emissions exceed 100 tons per year, CAM requirements apply to Ghent Units 1, 2, 3 and 4 for SAM emissions. This CAM plan addresses the proposed method of monitoring compliance indication with the applicable SAM emission limits pursuant to 40 CFR Part 64.

## 1.3 MONITORING APPROACH FOR SAM

SO<sub>3</sub> is generated in the boilers due to the oxidation of sulfur in the combustion process and, at Ghent Units 1, 3 and 4, further oxidation occurs within the SCR. The amount of SO<sub>3</sub> generated is a function of coal sulfur content, SCR catalyst SO<sub>2</sub> to SO<sub>3</sub> conversion rate, and flue gas temperature within the SCR and boiler. SO<sub>3</sub> reacts with water in the flue gas to form SAM vapor, which then condenses to form sub-micron SAM. KU has undertaken a series of steps to reduce and further control SAM emissions at Ghent Generating Station. The activities include installation of permanent SO<sub>3</sub> mitigation systems with trona<sup>1</sup> milling capabilities and dry

<sup>1</sup> Trona is a sodium-based dry sorbent material. Ghent’s SO<sub>3</sub> mitigation systems can use trona and/or hydrated lime (another dry sorbent material) for SAM mitigation.



sorbent mixing processes to enhance sorbent effectiveness and removal efficiency of the SO<sub>3</sub> mitigation systems. Additionally, Ghent Generating Station will be performing boiler system work to reduce and manage boiler exit gas temperatures.

Ghent Generating Station's primary control mechanism for SAM formation and emissions will be the SO<sub>3</sub> mitigation system installed on each unit. Each SO<sub>3</sub> mitigation system consists of sorbent receiving, sorbent storage and sorbent injection systems. Each SO<sub>3</sub> mitigation system that utilizes the trona product will also be equipped with trona milling equipment.

The effectiveness of the SO<sub>3</sub> mitigation system is a function of the sorbent injection rate relative to the SO<sub>3</sub> concentration. The controlled SO<sub>3</sub> concentration is affected by several factors including: sorbent stoichiometric ratio (e.g., ratio of sodium to sulfur or calcium to sulfur), sorbent particle size and physical characteristics (e.g., surface area), degree of sorbent mixing in the flue gas, residence time and some boiler and atmospheric conditions. When using sodium-based sorbents (e.g., trona), milling technology can be used to add additional surface area to the sorbent to increase the sorbent's effectiveness. The hydrated lime product does not require further milling.

For CAM purposes, KU will use a SAM indicative monitoring system as the primary indicator of performance of the SO<sub>3</sub> mitigation systems. The SAM indicative monitoring systems will provide an indication of SAM levels for each unit. The monitors will be located at the stack emission monitoring level for Ghent Units 1 and 4 and at the FGD outlet ducts of Ghent Units 2 and 3. For instances when the SAM indicative monitoring systems is malfunctioning or removed from service for maintenance, KU will further develop and monitor performance indicators to ensure that the SAM control system performance is maintaining compliance with emission limits.

Unit specific SAM compliance demonstration testing will be used to determine SAM emissions levels in accordance with compliance demonstration procedures defined in Appendix A of the Consent Decree **that was incorporated into the station's current Title V permit**. Emissions testing will be conducted at three separate electrical generation conditions (i.e., low, mid, and high load) for each Ghent unit. Targeted electrical generation rates for these compliance demonstration tests are shown in Table 1.3.1.

**TABLE 1.3.1: TARGETED GENERATION RATES FOR SAM COMPLIANCE TESTS**

<b>Targeted Test Generation (MWg)</b>		
<b>Low</b>	<b>Mid</b>	<b>High</b>
375	450	510

During each compliance demonstration test, the output of the SAM indicative monitoring system will be monitored. The SAM indicative monitor's average outputs collected during the compliance demonstration test will be used to establish a correlation to the compliance demonstration test results. That correlation will be applied to the SAM indicative monitors output. After each subsequent compliance demonstration test, the correlation will be evaluated using the data collected from each test. The correlation will be adjusted, as needed, based on those evaluations. As the primary CAM indicator of the SO<sub>3</sub> mitigation system's performance,

the correlated SAM indicative measurements will be evaluated on a three-hour rolling average basis against each unit's applicable SAM limit (i.e., interim or final as seen in Table 1.1.3).

KU will also develop a dry sorbent injection (DSI) rate matrix for each unit that represents the appropriate amount (e.g. pounds per hour) of dry sorbent to be injected to assure proper performance of the SO<sub>3</sub> mitigation system. These sorbent injection rates will be used as the alternate performance indicator. The alternate performance indicator will be used when valid SAM indicative monitor data is unavailable (e.g., periods of monitor maintenance or malfunction). The relationship between DSI rate, unit generation in gross megawatts (MWg), and the FGD outlet SAM emission rate at the three targeted test generation levels will be developed from data collected during compliance demonstration testing. The relationship will be evaluated following each subsequent compliance demonstration test. The relationship will be adjusted, as needed, based on those evaluations. Sorbent injection rates will be monitored on each unit and compared, on a three-hour rolling average basis, against the minimum injection rates established for that unit's sorbent injection rate matrix as an alternate indication of compliance.

This CAM plan is being submitted as required under the terms of the **current Title V permit that incorporated the** Consent Decree. The monitoring approach outlined in Table 1.3.2 provides the ongoing assurance of compliance with the SAM emission limits shown in Table 1.1.3. The specific details regarding each monitoring method and the monitoring performance criteria are provided in Tables 1.3.3 and 1.3.4.

**TABLE 1.3.2: SUMMARY OF SAM MONITORING APPROACH**

Method	Indicator Parameter	Range	Frequency
1. SAM Indicative Correlation (Primary Indicator)	SAM Indicative Monitor Output	Interim or Final Emission Limit, as applicable	3-Hour Rolling Average
2. DSI Rate per Gross Generation (MWg) Relationship (Alternate Indicator)	DSI Rate	Established from data obtained during compliance demonstration testing.	3-Hour Rolling Average

**TABLE 1.3.3: PRIMARY SAM COMPLIANCE INDICATOR— SAM INDICATIVE MONITOR CORRELATION**

GENERAL CRITERIA	
Indicator	SAM Indicative Monitor Output
Measurement Approach	The <b>continuous</b> SAM Indicative Monitor output will be recorded <b>as hourly averages</b> and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Using the results of compliance demonstration test results performed pursuant to the <b>Title V permit that incorporates the</b> Consent Decree and average SAM Indicative Monitor output values collected during those tests, a correlation will be developed using regression analysis. Following the development of the correlation, the SAM Indicative Monitor's output will be adjusted according to that correlation. The correlation adjusted SAM Indicative Monitor's output data will be



	reduced to three-hour rolling averages and compared with each unit's applicable SAM emission limit. An excursion of SAM indicative monitor data is defined as occurring when the three-hour rolling average of correlated SAM Indicative Monitor output values exceeds the applicable interim or final emission limit.
Corrective Actions	In response to an excursion, KU shall (A) Complete an inspection of the SAM Indicative Monitor system to determine any potential problems with data collection or validation and correct any revealed performance issues in an expedient manner; and (B) Complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner. (C) If corrective actions are not successful in returning the performance indicators to compliant ranges, KU shall perform an additional stack test to confirm or update the SAM Indicative Monitor correlation and/or DSI per MWg relationships.
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness/ Applicability	The correlated output of the SAM Indicative Monitoring System at each location will be compared to applicable interim and final emission limits.
QA/QC Practices and Criteria	(A) KU shall follow the installation, calibration, and startup procedures of the SAM Indicative Monitoring System in accordance with good engineering practices. (B) KU shall continue to calibrate and maintain the SAM Indicative Monitoring System in accordance with good engineering practices.
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator data collection system (PI)
Averaging Period	1-hour values reduced to 3-hour rolling averages
Recordkeeping	Hourly SAM Indicative Monitor output and 3-hour rolling averages of the SAM Indicative Monitor output. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	Per Ghent Station's Title V operating permit Section B, Table 1, a summary of excursions and corrective actions will be included in the semi-annual Consent Decree report and in the Title V report.

**TABLE 1.3.4: ALTERNATE COMPLIANCE INDICATOR — DRY SORBENT INJECTION per GROSS GENERATION (MWg) RELATIONSHIP**

<b>GENERAL CRITERIA</b>	
Indicator	Dry sorbent injection (DSI) rate
Measurement Approach	DSI rate will be used when valid SAM indicative monitor data is unavailable. DSI rate (pounds per hour, lb/hr) will be monitored continuously, an average will be recorded hourly, and the data captured will be reduced to 3-hour rolling averages.
Compliance Indication	Minimum DSI rates will be determined using operational data gathered during compliance demonstration stack testing performed pursuant to the Title V permit that incorporates the Consent Decree. If, based on performance tests, the current acceptable DSI indicator ranges need to be amended, KU shall submit the new ranges to the Kentucky Division for Air Quality's Florence Regional Office for approval pursuant to consent decree

	<p><b>requirements.</b> An <b>excursion</b> of this section of the CAM plan will only be applicable if the primary indicator (correlated SAM Indicative Monitor output) is not capable of collecting accurate data (i.e., malfunction or undergoing maintenance). An <b>excursion</b> of this section of the CAM plan will be defined if the three-hour rolling average of the DSI rates are below the minimum injection levels determined from the correlation described above. Current appropriate DSI rates can be seen in Appendix A of this CAM plan.</p>
Corrective Actions	<p>In response to an <b>excursion measure by the DSI method</b>, KU shall:</p> <p>(A) Complete an inspection of the DSI system as necessary to determine the cause of any injection problems and correct any revealed performance issues in an expedient manner.</p> <p>(B) If corrective actions are not successful in returning the performance indicator to compliant ranges, KU shall perform an additional stack test to confirm or update the DSI per MWg relationship.</p>
<b>PERFORMANCE CRITERIA</b>	
Data Representativeness/Applicability	<p>DSI data will only be applicable during periods when the SAM indicative monitor is not capable of collecting accurate data. The DSI injection rates will be determined from data collected during compliance demonstration <b>stack</b> testing.</p>
QA/QC Practices and Criteria	<p>(A) KU shall follow installation, operation, and maintenance procedures for the DSI system in accordance with good engineering practices.</p> <p>(B) KU shall continue to calibrate and maintain the DSI system will in accordance with good engineering practices.</p>
Monitoring Frequency	Continuous
Data Collection Procedure	Performance Indicator Data Collection System (PI)
Averaging Period	1-hour values reduced to a 3-hour rolling average
Recordkeeping	Hourly DSI rate and 3-hour rolling averages of the DSI rate. Associated upset conditions and monitoring malfunctions as applicable.
Reporting	Per Ghent Station's Title V operating permit Section B, Table 2, a summary of <b>excursions</b> and corrective actions will be included in the semi-annual Consent Decree report and in the Title V report

**TABLE 1.3.5: SUMMARY OF OPERATING CONDITIONS TO BE INCLUDED IN COMPLIANCE DEMONSTRATION TESTING**

Test Series	Number of Runs	Load Conditions	Sulfur Content	Sorbent Injection Rate
1	At least 3	High (target 510 MWg)	Within 90% of maximum expected	To be determined through testing
2	At least 3	Mid (target 450 MWg)	Within 90% of maximum expected	To be determined through testing
3	At least 3	Low (target 375 MWg)	Within 90% of maximum expected	To be determined through testing



## 1.4 MONITORING APPROACH JUSTIFICATION

### 1.4.1 Rationale for Selecting Performance Indicators

Use of a SAM Indicative Monitor output correlated to tested FGD outlet SAM levels provides an indication of compliance assurance at various operating conditions. As the primary indication of compliance assurance, the correlated SAM Indicative Monitor output will be used to prompt appropriate operational responses in relation to applicable interim or final SAM emission limits. For occasions when maintenance activities or malfunctions of the SAM Indicative Monitoring System occur, alternate compliance assurance indication is established by documenting DSI rates that meet or exceed the appropriate DSI injection rates established from data collected during compliance demonstration testing.

### 1.4.2 Rationale for Selecting Indicator Ranges

KU has followed and will continue to follow the compliance test frequency as described in the **Title V operating permit that incorporates the** final Consent Decree. During compliance demonstration testing that has been performed to date, SAM Indicative Monitor output and DSI rates have been collected for correlation to FGD outlet SAM test results and SAM compliance levels.

The SAM Indicative Monitor outputs have been correlated with the SAM test result data. Those correlations have been used to adjust the SAM Indicative Monitor outputs to produce a correlated SAM Indicative Monitor output to be compared with the applicable SAM emission limits on a three-hour rolling average basis. The correlations will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

The minimum DSI rates have been selected for each unit and can be found in Appendix A of this CAM plan. From data collected during compliance demonstration testing performed to date, the DSI rates found in Appendix A represent the appropriate minimum DSI rate to be used that indicate the unit's compliance with the applicable SAM emission limit. The DSI rates will be adjusted, as needed, based on data collected during each subsequent compliance demonstration test.

As described in **Section B, item 4(k) of the Title V operating permit that incorporates the** Consent Decree, the occurrence of certain material changes in operation at a Ghent unit will require additional Stack Tests to be performed. During these tests, a re-evaluation of the compliance indicator levels for the primary and alternate indicators will also be performed. As required in **Section B, item 4(k)(i) of the Title V operating permit that incorporates the** Consent Decree, the monthly average fuel sulfur content of the coal burned will be monitored. If the monthly coal sulfur content increases by more than 20% above the sulfur content of the coal used during the previous compliance demonstration test, a Stack Test will be conducted within 60 days. Data collected during the test will be used to determine if adjustment to the SAM Indicative Monitor correlation is needed and if a new relationship between DSI rate and the gross generation rate is warranted.

In addition, if any of the events listed below are expected to last for more than 60 days at any Ghent unit, KU shall conduct a stack test within 60 days of the relevant change and use the

results of that stack test to adjust the relationship to the SAM Indicative Monitoring system and the DSI rates, as necessary.

- The material replacement, or change in design, of SAM emissions control equipment at any Ghent Unit.
- A change in the type of fuel used at any Ghent Unit to a fuel not permitted for use at that Unit prior to the Date of Entry of this Consent Decree.
- A change in the type of sorbent material used for SAM emission control at any Ghent Unit.



## APPENDIX A

### Alternate CAM Indicator Ranges for Ghent Generating Station Dry Sorbent Injection (DSI) Rates per Gross Electrical Output (MWg)

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 1					
	Above 500 MW		500 to 450 MW		Below 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2700	3200	1500	2800	1000	1750
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 2					
	> 500 MW		500 to 450 MW		< 450 MW	
	A-Duct Injection Rate (lb/hr)	B-Duct Injection Rate (lb/hr)	A-Duct Injection Rate (lb/hr)	B-Duct Injection Rate (lb/hr)	A-Duct Injection Rate (lb/hr)	B-Duct Injection Rate (lb/hr)
≥6	1300	1400	1000	1400	500	1300
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 3					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	500	500	500	500	500	500
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	500

SO <sub>2</sub> (lb/mmBtu)	Ghent Unit 4					
	> 500 MW		500 to 450 MW		< 450 MW	
	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)	Inlet Injection Rate (lb/hr)	Outlet Injection Rate (lb/hr)
≥6	2400	2500	2000	2000	1000	1250
5-5.9	500	500	500	500	500	500
≤4.9	500	500	500	500	500	350



a PPL company

April 25, 2016

**CERTIFIED MAIL**  
**RETURN RECEIPT REQUESTED**  
**CERTIFIED NUMBER 7015 1520 0000 7955 5569**

Mr. Sean Alteri  
Director  
Kentucky Division for Air Quality  
200 Fair Oaks Lane, 1<sup>st</sup> Floor  
Frankfort, KY 40601

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www.lge-ku.com

**CERTIFIED NUMBER 7015 1520 0000 7955 5576**

Chief, Environmental Enforcement Section Environment and Natural Resources Division  
U.S. Department of Justice  
Box 7611 Ben Franklin Station Washington, D.C. 20044-7611  
Re: DOJ No. 90-5-2-1-08850/1

**CERTIFIED NUMBER 7015 1520 0000 7955 5583**

David Lloyd  
Air, Pesticides and Toxics Management Division  
Air and EPCRA Enforcement Branch  
U.S. Environmental Protection Agency, Region 4  
61 Forsythe Street  
Atlanta, GA 30303

Re: KU's Ghent Generating Station CAM Plan for SAM Emissions  
Related to biannual SAM testing of KU Ghent Unit 4

Dear Mr. Alteri:

Per Section VI, paragraph 23.b of the Consent Decree entered in *United States v. Kentucky Utilities Co.*, Case No: 3:12-cv-00076-GFVT for the Ghent Generating Station, Kentucky Utilities (KU) is required to submit to the Kentucky Division for Air Quality (KDAQ), for review and approval, any necessary revisions to its Compliance Assurance Monitoring (CAM) plan for sulfuric acid mist (SAM) Emission Rates within 60 days of completion of a Stack Test required by paragraph 22.b of the Consent Decree. The initial CAM plan was submitted to KDAQ on October 3, 2013. KDAQ approved the CAM plan on February 4, 2014. KU has subsequently submitted additional revisions of the CAM plan on April 21, 2014, July 11, 2014, November 21, 2014, January 30, 2015, May 6, 2015, July 10, 2015, December 14, 2015, and February 15, 2016 due to SAM testing that was conducted on the KU Ghent Units.

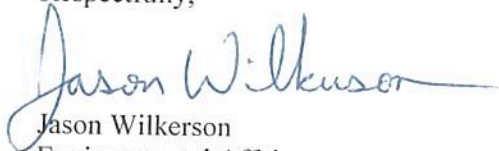
Following bi-annual stack testing that was conducted in fulfillment of paragraph 22.b of the Consent Decree on KU's Ghent Unit 4 (February 23-25, 2016), KU has identified that revisions to the alternate CAM indicator ranges for Ghent Unit 4 are not necessary. Therefore, the revised plan submitted on February 15, 2016 remains the current version of Ghent's CAM plan for SAM emissions.



Additionally, from application of the stack test results to the on-going evaluation of the SAM indicative monitor's output relationship to stack test results, the SAM indicative monitor's correlations for Ghent Unit 4 will be adjusted slightly. Since Ghent Unit 4's testing was completed on February 25<sup>th</sup>, this submittal is being made within the 60 day deadline detailed in paragraph 23.b of the Consent Decree.

If KDAQ needs additional information regarding this submittal, please contact me at (502) 627-4043 or [jason.wilkerson@lge-ku.com](mailto:jason.wilkerson@lge-ku.com).

Respectfully,

A handwritten signature in blue ink that reads "Jason Wilkerson". The signature is fluid and cursive, with a long horizontal stroke at the end.

Jason Wilkerson  
Environmental Affairs  
LG&E and KU Energy, LLC

Enclosures

EC: Rick Shewekah, KDAQ  
Clay Redmond - KDAQ Florence Regional Office  
Courtney Shattuck - KDAQ Florence Regional Office